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Band Seeding in the Establishment of Hay and Pasture Crops

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SUMMARY

Band seeding is an improved method of seed and fertilizer placement. Small grass and legume seeds are placed at precise depths, directly above a concentrated band of fertilizer. Plant food is readily available to the young seedling immediately upon germination. This results in hardier young plants that are better able to withstand droughts and low temperatures and greatly increases the possibility of obtaining a good stand.

Band seeding is not without disadvantages, however. There are limitations to its use. Specialized equipment, or changes in standard equipment, is necessary, and some change in practices is recommended.

Although considerable research is still needed, field tests and farm use indicate that the method has a definite place in crop production.

Information in this report was provided by the Field Crops Research Branch and the Agricultural Engineering Research Branch, Agricultural Research Service

BAND SEEDING IN THE ESTABLISHMENT OF HAY AND PASTURE CROPS

Band seeding as a method of forage plant establishment is one of the newest concepts in agriculture. For centuries pastures and hay fields have been broadcast seeded. Hand-sowing methods were modified as machines took over farm tasks, but the basic method remained unchanged. Only in very recent years has attention been given to the accurate placement of pasture seeds in relation to fertilizer. The method of band seeding was developed, and, as used in this report, refers to the concentration of legume and grass seeds directly above, but not in contact with, drilled bands of fertilizer.

The feasibility of this method of planting was demonstrated in tests conducted by various State agricultural experiment stations and by the Agricultural Research Service of the U. S. Department of Agriculture. Greatly increased yields of forage under certain adverse conditions have been obtained from plots that were band seeded in comparison with those which were broadcast, and recent tests revealed an even more important advantage of band seeding.

RESULTS OF EXPERIMENTS AT BELTSVILLE, MD.

In 1952, twenty-four randomized treatments replicated four times were seeded on a prepared seedbed at the Agricultural Research Center. Tall fescue and ladino clover were used as the pasture mixture. Fertilizer and seeds were applied at various depths and in various amounts, but the essential comparison was between broadcast and band-seeded plots. The most effective method of establishment was the combination of drilling fertilizer $1\frac{1}{4}$ inches deep and seeds $\frac{1}{4}$ inch deep. Several advantages of band seeding were noted.

1. Band-seeded plots yielded 130 percent more forage than where the same amounts of fertilizer and seed were broadcast. Where only half as much seed and one-third as much fertilizer were banded as were broadcast, forage yields were 29 percent greater.

2. Weed growth was very light on band-seeded plots but was heavy on broadcast plots.

3. Plants in the band-seeded plots got off to a more vigorous start which contributed to a higher survival rate later, when weather conditions were unfavorable.

4. Costs of planting with fertilizer were lower on the band-seeded plots since fertilizer and seed were applied in one operation.

Increased yields at low-seeding and fertilization rates was the most spectacular of the advantages revealed, but a recently discovered advantage may be of even more economic importance to farmers. Latest experiments, with lespedeza sericea and orchard grass in band-seeded and broadcast plots, show that band seeding will give good stands even when planting is done considerably earlier or later than is usually recommended. By comparison, broadcast plots seeded much earlier or later than usual had a very low survival rate and gave poor yields. When weather conditions delay seeding, this extension of the planting season can greatly increase the likelihood of securing a stand and the likelihood of obtaining an adequate supply of hay and pasture.

The good stands that result from band seeding, whether planted early or late, can be attributed to the early vigor of the seedlings. Placement of the fertilizer directly below the seed enables the first roots to obtain nourishment immediately. The rapid growth that results enables seedlings to better withstand droughts, freezes, competition, and other hazards.

The band-seeding method is not without disadvantages, however. An investment in special grassland drills or in conversion of grain drills is necessary, and careful alignment and adjustment are essential if an advantage is to be obtained. The preparation of a firm seedbed and shallow planting are doubly important. Top-seeding on winter grains may not work too well. Despite these facts, band seeding gives promise of taking much of the risk out of getting a stand.

BAND SEEDING EQUIPMENT

Experimental equipment, developed by the Agricultural Research Service in 1951 and modified since, accurately places the fertilizer, grass seed, and legume seed in either broadcast or drilled patterns. In drilling or banding, to give greater response in establishment, the following takes place:

1. Double disks open a furrow about 1¼ inches deep into which the fertilizer is deposited and then covered. The soil is then firmed by a double press wheel.

2. Next a single disk cuts a shallow furrow approximately ¼ inch deep, leaving a 1-inch layer of soil between the fertilizer and the grass seed, which is deposited next.

3. Grass and legume seeds are usually deposited one after the other, from separate hoses but at the same depth.

4. A small amount of soil falls over onto the shallow-planted seed and is also firmed by a narrow press wheel.

A single disk was found preferable for opening the seed furrow since it causes the fine dirt to roll back onto the planting, although the legume seed is only slightly covered.

Furrow depths are controlled by a gauge wheel mounted alongside of each disk unit, and all tubes are anchored in such manner that the seed is dropped directly above the band of fertilizer.

Since accurate metering of different-sized materials through the same mechanism is difficult, separate boxes are provided for fertilizer, grass seed, and legume seed.

1. Fertilizer is carried in a positive-delivery hopper similar to those used on a corn planter. Steel ribbon tubing carries it to the ground.
2. Grass seed is carried in a special seedbox utilizing an adjustable internal-run wheel with eccentric agitators in the throat of each metering unit to prevent long, fluffy grass seeds from stacking up. Plastic tubing carries the seed to the ground.
3. Legume seed is carried in a standard legume box. Again plastic hoses carry the seed to the ground.

Narrow press wheels, directly behind the legume tubes, are preferable to a land roller since they provide compaction only for the pasture seeds. When the entire field is rolled germination of weed seeds between the rows is more likely since they are firmed in as well as the legumes.

The ARS equipment is designed for experimental work and is too elaborate for general farm use.

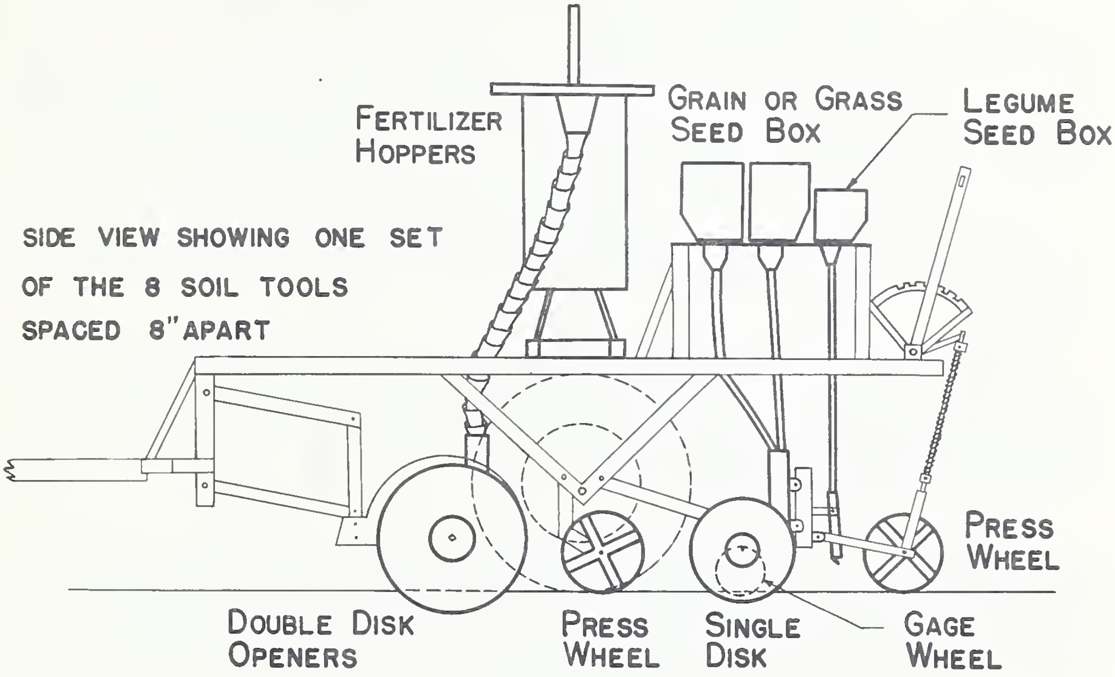

Figure 1.--USDA Special Grassland Drill used in field experiments. Seed and fertilizer may be drilled separately or in contact with each other. Both materials may be broadcast, or drilled and broadcast in various combinations.

Commercial equipment for band seeding may be purchased from several companies. These seeders are equipped with separate fertilizer, grass, and legume boxes. Some are sod planters which can be used for pasture renovation as well as for band seeding on a prepared seedbed. Others can only be used on a prepared seedbed. In either case, the order of operation is essentially the same except that the sod planters use a coulter to cut the sod before the furrow is opened. Some type of shovel opens the furrow and fertilizer is dropped at the desired depth. Soil then flows into the furrow and grass seed is dropped. A small amount of soil falls on top of the grass seed. Then the legume seeds are deposited on the surface. Both plantings are made directly above the fertilizer and press wheels firm the dirt around the seeds.

Converted grain drills may also be used for band seeding. Three boxes are essential and a combination fertilizer-grain drill equipped with a legume box makes a good piece of machinery for planting legumes, timothy and other small pasture seeds by themselves. Most pasture plantings, however, include a long, fluffy seed such as brome grass, orchard grass, or tall fescue. These seeds are too large for the metering mechanism in the legume box and therefore are carried in the grain box. But here they tend to stack in the throat of the grain metering unit or to feed unevenly, unless they are mixed with a carrier such as a cereal grain. If an agitator is added to the grain box, a carrier may not be necessary. Despite the difficulties, band seeding of legumes and grasses is possible.

Separate hoses are run from each of the boxes and brackets are provided to hold the hoses the proper distance apart and directly in line, so that the seeds are deposited directly above a band of fertilizer. When only small, free-flowing seeds are planted, only two sets of hoses are used.

The fertilizer tube is allowed to remain in the boot alongside the single disk furrow opener. It places a band of fertilizer about 1¼ inches deep. The tube from the grain box, carrying the grass seed, is relocated 9 inches or more to the rear of the fertilizer tube. This distance allows time for soil to flow back into the furrow and separate the fertilizer from the grass seed. The legume seed tube can be placed either directly behind the grass seed tube or 2 to 3 inches farther back. It is not important that soil separates the grass and legume seed, but it is important that the legume seed fall onto the irregular surface of the soil. It is better for the grass seed to be planted a bit shallow than for legume seeds to be placed too deep.

Proper distance between the 3 hoses can be judged by placing small amounts of fertilizer in all three boxes and making test runs at the speed the seeding will be made. The deposits can be quickly checked to be sure that soil separates the fertilizer and seed and that the band of legume seeds is not excessively covered.

The hoses and material for brackets required for conversion may be purchased from a machinery or hardware dealer. One inch pipe-hanger strap metal makes satisfactory brackets since it can be readily shaped around the hoses and held securely by bolts. Careful attention should be given to lining up the grass and legume tubes to be sure that the seeds are dropped directly above the fertilizer.

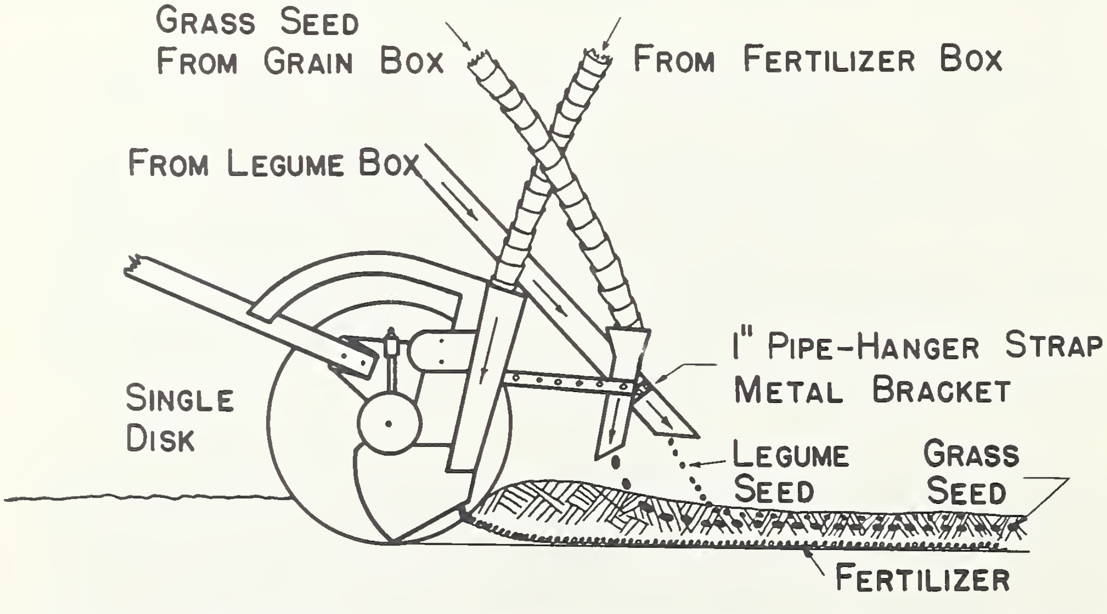

Figure 2.--Combination fertilizer-grain drill equipped with a legume box, conversion hoses, and brackets. Length of the bracket is adjustable according to speed of the drill and condition of the soil. Test runs should be made, and the position of the hoses adjusted until proper placement is attained.

Best results can be obtained if the drilling operation is followed by a packing operation. Press wheels, located in line with the legume bands, provide compaction only for the seeding. A land roller may, of course, be used, but press wheels are preferable for the reason mentioned earlier. Whichever method of packing is followed, soil conditions should be checked to be sure that legumes are only slightly covered.

BAND SEEDING ON A PREPARED SEEDBED

Band seeding on a prepared seedbed gives best results because more exact seed and fertilizer placement is possible.

Time of seeding should be in line with State recommendations whenever possible. Band seeding, however, makes it possible to extend the planting period either earlier or later than is usually recommended.

Planting on a prepared seedbed may be done in the spring, but a great many pastures are put in during the late summer or fall, after the removal of other crops. Summer seedlings are particularly vulnerable to droughts and winter-kill, but they make possible the harvest of another crop before pasture establishment is undertaken. Regardless of the time of year, planting on a prepared seedbed is done in much the same way.

After plowing, time should be allowed for the soil to firm and store moisture. Seeding should be undertaken immediatedly after final seedbed preparation. Final preparation should be planned to coincide with the optimum seeding date.

Methods of band seeding will vary slightly according to the equipment available. In any case, fertilizer should be placed about an inch below the seeds; the seeds themselves should be placed close to or on the soil surface and directly above the bands of fertilizer.

The fertilizer used should follow local recommendations, and the quantity of seed sown should conform to recommended rates for drilling.

Immediately after seeding, a mulch may be applied to conserve the moisture and to prevent crusting. Straw may be applied at about 1 ton to the acre. If no mulch is applied during the summer, the seeding may be top-dressed with manure early in the winter to protect plants from heaving. Summer or fall seedings should not be clipped, mowed, or grazed, until the young plants are well-established; i.e., to be sufficient size to produce a light but worthwhile cutting of hay. Such growth may not develop until the following spring or summer. In some cases, however, weed-growth may necessitate clipping before the crop reaches the hay stage.

BAND SEEDING WITH A COMPANION CROP

Under some conditions a companion crop is detrimental to stand establishment of hay and pasture plants. The faster-growing companion or nurse crop, which occupies the land at the same time as the pasture seeding, robs the latter of sunlight, moisture, and plant food. Despite these detrimental effects, the majority of farmers use a companion crop to obtain income from the land the year of seeding down, to help control weeds, and to reduce erosion. In planting, the grain may also serve as a conditioning carrier for metering the long, fluffy seeds that may be used in establishing hay or pasture crops. Band seeding helps hay and pasture plants to compete successfully with a companion crop that is planted either in the spring or in the preceding fall.

Band Seeding With Spring-Planted Crops

Band seeding can lessen the detrimental effects of spring-planted companion crops by providing the pasture seedlings with the early vigor necessary for successful competition. The detrimental effects can also be lessened by choosing an early-maturing, lodging-resistant variety of grain as the companion crop, by early clipping, and by using the companion crop for hay or silage rather than waiting until grain-harvest time to remove it.

Band seeding with a companion crop may be less of a problem for the man who owns the converted fertilizer-grain drill described earlier, than planting the grain and the forage seeds separately. The grass seed may be mixed with the grain and planted from the grain box, and the entire planting made in one operation. If the grain box is equipped with an agitator, however, he may prefer to perform the planting in two operations and thus avoid planting the forage-grass seeds too deep. Each method has an advantage.

1. He may deposit the fertilizer from the fertilizer box; plant a mixture of the fluffy grass seeds and the cereal from the grain box; and plant the free-flowing forage seeds from the legume box. This method places both crops in the ground in one operation and reduces danger of stacking of grass seed in the throat of the metering mechanism. It does, however, require laborious mixing, and the planting of grass seed will be too deep unless the grain-grass seed mixture is placed closer to the surface than grain is usually planted.
2. He may elect to do the seeding in two operations:
   a. Cereal and fertilizer may be drilled at the usual depth.
   b. Fertilizer may then be placed in the fertilizer box; fluffy grass seed in the grain box; and fine, free-flowing seed in the legume box. The furrow opener then places the second band of fertilizer less deeply than the already-planted-and-fertilized companion crop. The forage seeds are planted above the second band of fertilizer. Best results can usually be obtained by making the second planting at an angle to the cereal planting. No seed mixing is required.

In each case when planting the grain, alone or with the grass seed, the grain tubes should be released from the special bracket and returned to their original location alongside the furrow opener.

Whichever method is followed, the legume seeds should be dropped far enough behind the furrow openers to be covered only lightly. Individual press wheels, lined up with the legume tubes, provide the best method of covering, providing the seedbed is well packed. If the seedbed is loose, however, any packing operation is likely to cause excessive coverage. Leaving legume seeds uncovered is preferable to covering them too deeply.

Band Seeding In a Fall-Planted Crop

Springtime band seeding of forage-seed mixtures onto winter grains has not proved very successful in areas where frozen ground is a spring problem. When a hay or pasture seeding is made before a thaw, onto fall-planted small grains, the furrow openers cut grooves, the soil fails to fall back, and the furrow is not filled uniformly. In such cases it is difficult, if not impossible, to drill the fertilizer and seed at different depths. When seeding is held off until after a thaw, considerable time may elapse before the ground is dry enough to support machinery. The late-seeded plants may not attain sufficient growth to withstand summer droughts.

Since an early start is important in establishing forage grasses and legumes in a winter grain companion crop, it may be better to broadcast seeds while the ground is frozen, rather than wait until band seeding can be done. However, if seeding on winter grains is unavoidably delayed in these areas, drilling the seed, as is done in band seeding, will insure better stand establishment than broadcasting.

In other areas, where seeding is not seriously delayed by wet or frozen soil, band seeding may prove very satisfactory in fall-planted crops.

Band Seeding on Corn Plantings

Band seeding may have a place in the wide-row corn planting system. Several of the major corn-producing States have carried on research with this system, in which forage crops are broadcast between widely-spaced rows of corn. Band seeding may prove helpful in avoiding the weed problem since the fertilizer placement favors the forage seed and is not available to stimulate weed growth between the drilled rows.

In wide-row plantings, corn rows are spaced 60 to 80 inches apart. To maintain satisfactory plant populations, closer planting within rows is used. Stands at harvest time should average between 130 and 150 plants for each bushel of corn the land is capable of producing. In other words, an acre of wide row corn should contain the same number of plants per acre as normal-row corn, but the plants are concentrated in fewer rows. Despite these measures, slightly lower corn yields usually are obtained. Whether this difference will be offset by the value of the forage crop depends upon the individual farmer's needs for hay, pasture, green manure, or erosion control.

The forage crop is usually seeded sometime after the second corn cultivation, and if band seeding is done, it should be done in the same manner as described for a prepared seedbed. If it is to be harvested for hay, some difficulty will be experienced with rough ground and corn stubble.

Additional research is necessary to determine the best grasses, legumes, and planting practices for use with corn, but research already completed indicates that the method promises maximum production of corn, forage, and ground cover for a given acreage.

BAND SEEDING WITH PASTURE RENOVATION

Band seeding is proving a valuable tool in the renovation of pastures. Although renovation treatments vary according to soil tests and the results desired, application of fertilizer and seed is usually included in the treatment. Band seeding performs these functions and provides the pasture plants with the early vigor necessary for them to compete successfully with mature plants that may have survived from the original pasture. In addition, weed competition is not encouraged by band seeding as it is by broadcasting, since no fertilizer is available to weeds growing between the band-seeded rows. However, accurate placement is not as easy when band seeding in sod as it is on a prepared seedbed.

Three companies are currently putting out pasture renovators which cut the sod with a coulter, deposit fertilizer at the depth desired, rake soil back into the trench before the grass seed is dropped, and pack the soil over the seed with a press wheel.

WHAT'S AHEAD FOR BAND SEEDING?

Results of research under controlled conditions suggest that band seeding has a definite place in the establishment of grass and legume plants. Outstanding increases in first-year forage production and substantial reductions in weed competition have been obtained. However, a very significant long-run advantage of band seeding may lie in the greater probability of obtaining a stand on fields that are planted early or late. The response of seedlings to fertilizer placed immediately below shows that this method increases farmers' chances of getting a stand under adverse conditions. This does not mean, however, that band seeding can be substituted for proper seedbed preparation or for good planting and management practices.

Considerable work remains to be done on fertilizer ratio, fertilizer placement, degree of precision necessary, and type of machinery. Further study is also required to determine the species and practices best adapted to soils and weather conditions of particular areas.

Current research is seeking to determine the advantages and disadvantages of seeding forage grass and legume plants between the rows of a companion crop, and the location of fertilizer that will give adequate yields of the companion crop, with minimum competition to the forage seedlings. Research is also being carried on with State experiment stations on various aspects of band seeding and to determine ways of overcoming the crowding-out effect of established plants on areas being renovated.

Of the many experiments under way in this field, those most likely to change present concepts have to do with the response of plants to the specific elements that make up a complete fertilizer. Nitrogen is commonly looked upon as a growth stimulator, but recent ARS results seem to indicate that applications of either nitrogen or potash alone--or in combination--are apparently detrimental to germinating seeds and seedlings. But phosphoric acid, applied alone, has no detrimental effect and appears to provide the desired stimulus to germinating seeds. In addition it can be placed in contact with legume and grass seeds with little or no injury to germination. Therefore, it is believed that seeds planted in contact with superphosphate may respond at least as vigorously as those planted above a band of complete fertilizer. If this expectation materializes, substantial changes in the design of band-seeding machinery will be in order.

What variations may be called for in establishment of hay and pasture crops and in management practices can only be surmised, but they will probably be numerous. This is hardly surprising when it is realized that the last twenty centuries have brought little change in the method of planting forage crops, and that grass-legume seeding failures outnumber successful establishments in some years. Research programs of the ARS and State experiment stations are directed toward attaining needed improvements.

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